N87-24279

DIFFUSE INFRARED EMISSION OF THE GALAXY: LARGE SCALE PROPERTIES

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The IRAS survey is used to study large scale properties and the origin of the diffuse emission of the Galaxy. A careful subtraction of the zodiacal light enables us to present longitude profiles of the galactic emission at 12, 25, 60 and 100 μm.

1. About 2/3 of the power radiated in the 100 μm band comes from the diffuse medium (atomic, molecular and ionized components), the other 1/3 coming from well identified luminous sources (complexes of giant molecular clouds (GMC) and HII regions). The sources have a much lower 12μm/25μm and a much higher 60μm/100μm emission ratio than the diffuse component, giving a very striking anticorrelation in the colour-colour diagrams. The emission from the sources will not be further discussed here.

2. The diffuse radiation observed at 12 and 25 μm represents a large fraction of the far-infrared emission. The absence of any strong colour gradient across the Galaxy implies that most of the emission up to 60 μm is produced by small particles through temperature fluctuations.

3. The large scale galactic structure is clearly seen at $b=1^\circ$, and even much higher. The dust producing the strong emission excess for longitudes smaller than 30° at $b=1^\circ$ is located about 150pc above or below the galactic plane, a height where the gas is mostly atomic hydrogen. The clear difference in gas scale height between the narrower molecular component and the broader atomic (and partially ionized) component is used to determine the contribution of each of these two components to the diffuse emission. Using an axisymmetric assumption for the infrared production rate, and taking optical depth effects into account, we simultaneously invert the diffuse infrared longitude profiles (successively for each of the 4 bands) at $b=0^\circ$ and $b=1^\circ$.

4. At all radii in the Galaxy the diffuse emission is dominated by the broad atomic component. In the "molecular ring" half of the 100μm emission is produced by this broad component, half by the sum of the cool molecular component and the bright sources.
In the solar neighbourhood the dust infrared emission per H atom is 4 times larger in the atomic gas than in the quiet molecular clouds. For atomic gas this emissivity is 6 to 8 times larger in the "molecular ring" than in the solar neighbourhood. These numbers imply that dust in molecular clouds is efficiently shielded from the external radiation, and that a significant part of the luminosity of O and B stars is absorbed in the atomic component. The emissivity in this widespread component measures the interstellar radiation field energy density (with strong weight in the ultra-violet), which increases almost by a factor of 10 between the solar neighbourhood and the "molecular ring".

A paper is in preparation, and will be submitted to Astronomy and Astrophysics.